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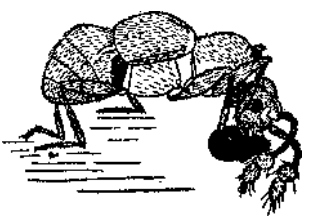
The Genus *Connodontus* (Coleoptera: Pselaphidae)

Orlando Park
Northwestern University



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Howard K. Gloyd, Director of the Museum

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The Genus *Connodontus* (Coleoptera: Pselaphidae)

Orlando Park
Northwestern University

Connodontus is a genus of batrisine pselaphids known so far only from Africa. Five species are recognized, including two described in the present report. These populations are poorly known, both taxonomically and ecologically. Both sexes are reported only for the genotype. No species has been recorded more than once, e.g. at the time of its description. None of the species have been studied while alive. The species are known from a few specimens and no data are available on intraspecies morphologic, physiologic, and ecologic variation. Finally, one of the new species departs so far from the traditional concept of the genus that it required subgeneric separation with the result that the genus had to be redefined and revised.

The taxonomy of the genus is in an unsatisfactory condition. This is especially unfortunate since all species of *Connodontus* are known from the nests of termites, and with the exception of a single specimen, all are known *only* from the nests of these hosts. Not only do we not have information on the role of these pselaphids in the complex termite society, but their termite hosts are very closely related indeed and there is the possible question of subspeciation in both hosts and inquilines.

COMPOSITION OF THE GENUS

Connodontus was erected by Raffray (1882, p. 52-53, pl. 2, fig. 17) for the genotype, *acuminatus,* described at that time. This is still the best known species, and is the only one in which both sexes are discriminated. *C. acuminatus* was collected twice by Raffray in the province of Bogos, Abyssinia; once five or six specimens were taken beneath a stone with termites, and on a second occasion a single specimen was taken from beneath a stone but no ter-

mites were found. Raffray concluded that since the last mentioned individual was found alone, the association of *acuminatus* with termites was accidental..

Wasmann (1904, p. 3) disagreed with Raffray's conclusion. He reported on a single specimen that had been collected by Tragardh in a nest of *Macrotermes natalensis* (Haviland) near Ghrab el Aish, north of Fashoda, on the White Nile, Sudan. Wasmann suggested that *acuminatus* was an habitual resident of termite nests, and further suggested that the beetle he studied fed on the numerous mites *(Uropoda)* that were attached to the termites or were loose in the nest. The author agrees with Wasmann's suggestion that *nodontus acuminatus* is an inquiline of termites, and probably feeds on the mites in the termite nest. This latter suggestion is in harmony with the direct observations and/or suggestions that non-symphilic pselaphids generally are predaceous and devour mites (Denny, 1825; Raffray, *in* Reitter, 1909, p. 201; Donisthorpe, 1927; Davey, 1945; Park, 1942, 1947a, b).

In the paper under discussion, Wasmann. *(op. cit.)* found several differences between his specimen and the description of *acuminatus,* and closed his comparison with the statement that should these differences really exist, he suggested that his specimen was the type of a new species for which he proposed the name *termitophilus.*

Silvestri (1905, p. 347) found several specimens of *Connodontus* in the nest of *Macrotermes bellicotus* (Smeathman) near Adi Ugri, Abyssinia. Silvestri identified these pselaphids as *C. termitophilus* Wasmann.

Raffray (1908, p. 146) stated that the pselaphids reported by Silvestri *(op. cit.)* were not *termitophilus* Wasmann, but belonged to a new, unpublished species for which he gave "Silverstrii, Raffr. i.l." without description, and a few lines later: "Sylvestrii, Raffray, nom. nov. *(termitophilus,* Silvestri, (nec Wasmann)."

In this 1908 paper Raffray (1) cited *termitophilus* Wasmann as a questionable synonym of *acuminatus,* and (2) stated that the findings of additional individuals of *Connodontus* with termites established this genus as termitophilous.

In the following year, Raffray (1909, p. 19) described the species collected by Silvestri *(op. cit.)* and named it *Silvestrii.* In the 1909 paper Raffray considered the genus as having three species: *acuminatus, termitophilus,* and *Sylvestrii,* with the first two being closely related. This brings the genus up to date, later lists by Raffray (1911, 1923-24) not altering the composition.

Of the two new species to be described shortly, one—*emersoni*—is in the *Connodontus* tradition, but the other—*manni*—departs from the rest of the genus in a basic generic character. All previous species had a pair of conspicuous lateral carinae on either side of the first tergite, but *manni* lacks the external lateral carina on each side of the first tergite. Accordingly, *manni*

will not key out to *Connodontus* in the 1908 Raffrayan arrangement for pselaphid genera of the world, and instead rues to wholly incompatible and widely separated aggregates *(Ophelius, Trisinus, Cylindroma, Batrisocenus* and *Cratna).* On the other hand, *manni* is typical *Connodontus* in all other respects, including the unique abdomen of the genus. Consequently it was felt that a new subgenus, *Manniconnus,* should be erected to contain *manni* as its type, and that *Connodontus* should be revised.

DIAGNOSTIC CHARACTERS OF CONNODONTUS, AS REVISED

Species of the genus *Connodontus* may be separated from other known Batrisini by the following combination of structural features.

1. Pronotum lacking longitudinal sulci.

2. Body cylindrical and fusiform.

3. Abdomen unique: conical and acuminate, with the intersegmental membranes very long so that the abdomen can be contracted some thirty per cent of its total length, the segments capable of being telescoped.

4. Five visible tergites in both sexes; six sternites visible in the male and five sternites visible in the female.

5. Lateral abdominal margins represented by either a pair of carinae on the first two tergites (subgenus *Connodontus),* or by a single carina on the first two tergites (subgenus *Manniconnus).* Where two carinae are present, they are subparallel, the external subentire and the internal extending to apical three-fourths of segmental length. Tergites not excavated.

6. Posterior coxae close together, with the matasternum acutely rounded between their subglobular mesial articular portions.

KEY TO THE KNOWN SPECIES OF CONNODONTUS

1 First tergite with a pair of subparallel carinae on each side (subgenus *Connodontus, s.s.)* 2

First tergite with a single carina on each side (subgenus *Manniconnus)* *manni* new species.

2 (1) Head, base of pronotum and first three tergites densely punctate-granulate, not shining; first three tergites bisected by an entire, median, longitudinal carina 3

Body shining, punctures sparse; first two tergites each with a median, longitudinal carina 5

3 (2) Each elytron with a deep dorsal stria to center of elytral length *termitophilus* Wasmann. Elytra with dorsal stria absent 4

4 (3) Six sternites visible — male *acuminatus* Raffray.
Five sternites visible — female *acuminatus* Raffray.

5 (2) Pronotum with a large lateral antebasal fovea on each side connected by a wide, deep, medianly sinuate transverse sulcus *silvestrii* Raffray.
Pronotum with a minute, indistinct lateral antebasal fovea on each side just discernibly connected by a faint, shallow, poorly defined transverse impression *emersoni* new species.

I have followed Raffray in considering *termitophilus* as a species. I do not know *termitophilus* and *silvestrii* except from their original descriptions. The key character used to discriminate *termitophilus* from *acuminatus* is a strong one, but the difficulty lies in interpretation of Wasmann's remarks. He states (*op. cit.*, p. 4) "und einer durch eine tiefe, bis zur Flügeldeckenmitte reichende Langsfurche abgegrenzten Schulterbeule" and cites in distinction to this Raffray's description of *acuminatus*. If Wasmann refers to the dorsal stria, the two species are probably distinct, but if the deep, longitudinal furrow refers to the subepipleural sulcus on elytral flank, then the two types must be examined comparatively.

Connodontus emersoni new species

Type (Female). Plate I, fig. 1, 2.

Measurements. Head (apical margin of clypeus to cervicum) **0.44** mm. long x **0.42** mm. wide; pronotum **0.49** x **0.42** mm.; elytra **0.68** x **0.7** mm.; abdomen **1.25** mm. long contracted and **1.66** mm. long extended. For this exceptional abdominal situation *see* below. Total length **3.3** mm.

Body uniform light reddish brown, with polished integuments; mandibles, maxillary palpi, distal half of antennal segments, and femora yellow. Pubescence moderately long but sparse.

Head with a pair of small vertexal foveae located on a line passing through posterior third of eyes, these foveae isolated and not connected by an interfoveal sulcus. Vertex gradually elevated from occiput but not otherwise modified. Front with a pair of large, deep, hemispherical cavities, each cavity located between an antenna! articulation and a longitudinal ridge; this frontal ridge is carinoid and bisects the front, and from a lateral view is sinuate. Clypeus broad, subtriangular, steeply declivous with a convex surface and not otherwise modified, merging gradually with the front. Mandibles well developed, with acute rami; left mandible crossed over right. Maxillary palpi four-segmented; segment I minute; II elongate-arcuate, basally slender, apically gradually swollen; III subtriangular, short, slightly longer than wide; IV

fusiform, slightly longer and wider than second, with a minute pinkish scar at center of external face (similar to that of the batrisine *Oxarthrius (Baroxarthrius) escharus* of Panama), and with a minute palpal cone at apex of segment. Eyes well developed, at about center of head, composed of about 52 facets. Ventral surface of head medianly, transversely gibbous, with a median, longitudinal carina from center to apical margin, and the basal half involved in a deep, conical fossa. Cervicum dorsally divided into four subequal, slightly concave areas by three longitudinal carinae, of which the median is the longest; ventral surface of cervicum with a median longitudinal carina from apical fifth into gular fossa noted previously. Antennae long and of the general proportions shown in Plate I; antennal segment I large and subpyriform; II to X obconical; III to X with basal halves bearing closely placed longitudinal striae (at high magnification each stria is composed of minute granules).

Pronotum of proportions. as illustrated; disk evenly and strongly convex, simple; at basal fourth there is a very small perforate lateral fovea on each side; these indistinct lateral foveae connected by a straight, very shallow, weakly defined transverse impression.

Elytra with sloping, unarmed humeri; each elytron with two small, nude basal foveae; sutural fovea apparently much larger as a consequence of its position at basal outlet of sutural stria; sutural stria entire but weakly formed; discal fovea petite; flank of elytron with a longitudinal carina from ventrad of humeral angle to apical elytral margin, this carina paralleled by a weakly formed longitudinal sulcoid impression that appears to arise apically in a minute subhumeral fovea.

Abdomen with five visible tergites in the proportions illustrated; tergite I and II with lateral margins represented by a pair of strong, subentire, subparallel carinae; I and II each with a strong, median, cuneiform carina that extends through basal third of first, and through basal two-fifths of second tergite; V with apex deeply incised as illustrated.

Abdomen with five visible sternites; sternite I with basal margin medianly erected into a short, semicircular process, the median point of which fits into a minute notch of the longitudinally sulcoid metasternum; sternite V simple, rounded-triangular.

Legs relatively simple; femora normally inflated, basal halves bearing closely placed longitudinal striae as described for antennal segments; tibiae slightly arcuate, external faces similarly striate; tarsi typical of batrisines, with a pair of stout, unequally developed tarsal claws.

Paratype (Female). This second specimen agrees with the above description with one exception: the basal elytral foveae are much larger, deeper and

paratype and, to this extent at least, describes variation within the population.

This description is based on two females (type and paratype) in the author's collection. They were collected by Dr. Alfred Emerson, June 9, 1948, in the fungus garden of a castle-like nest (four by four feet) of the termite *Macrotermes natalensis* (Haviland), at Rifflart, Belgian Congo, 14 km. south of Leopoldville, at an altitude of 310 m.

To the author at least, the most remarkable feature of *emersoni* is the abdomen, and it deserves special attention. Contrary to the condition found in Pselaphidae as a whole, there is an extensive alutaceous intersegmental membrane between the first and second, second and third, and third and fourth abdominal segments. When these specimens were received they were in alcohol, and the relatively long and acuminate abdomen was rendered much longer as a consequence of these membranes being fully extended. After mounting, the abdomen contracted as the membranes became folded between the segments. Plate I shows an intermediate condition between full expansion and contraction. The intersegmental membranes of *emersoni,* on measurement, made up one-third of the total abdominal length when expanded. This suggests that the abdomen could be elongated and contracted by one-third of its total length. This further suggests a much more movable abdomen than has been reported for any other pselaphid. Raffray (1908, p. 146) has already pointed out that the long and conical abdomen of *Connodontus* is paralleled in Pselaphidae only by the New Zealand genus *Eleusomatus,* and that these two pselaphid genera approached the hypothetical ancestral staphylinoid condition in this respect. Raffray had nothing to say on the intersegmental membranes. This is not to say that *Connodontus* is primitive by virtue of this staphylinoid abdomen. Rather, it is the author's view that the presumably highly motile abdomen of *emersoni* is a special adjustment to its life in the complex termite society. If this is tenable, it is an approach to the spectacular development of the abdomen in many genera of termitophilous and myrmecophilous staphylinids.

Connodontus manni new species

Type (Female). Plate I, fig. 3. Plate II.

Measurements. Head (apical margin of clypeus to cervicum) 0.47 mm. long x 0.47 mm. wide; pronotum 0.53 x 0.46 mm.; elytra 0.71 x 0.74 mm.; abdomen L28 mm. long contracted and 1.69 mm. (?) long extended. For this exceptional abdominal situation see relevant remarks in the description of *emersoni.* Total length 3.4 mm.

In general more robust than *emersoni.* This can be seen in the plates of the two species and is a conspicuous factor in the different habitus of *manni.* Coloration and pubescence as described for *emersoni.*

Head as described for *emersoni,* with the following differences. Vertex is strongly vaulted from the occiput to a point on a line through the anterior margins of the eyes (Pl. I, fig. 3); vertex with several, large, coarse punctures. Hemispherical cavities of the front deeper than in *emersoni,* and the longitudinal ridge separating them is medianly much more sinuate. The minute pinkish scar on the fourth segment of the maxillary palpi of *emersoni* is absent in *manni,* and this distal segment is relatively broader in *manni.* The median, longitudinal carina of the ventral surface of the head *is* less well developed in *manni.* Cervicum radically different from *emersoni,* the lateral carinae of the dorsal surface of the cervicum being absent in *manni* (Pl. II). Antennae in general similar to *emersoni,* and of the general form and proportions illustrated. The distal antennal segment of *manni* is much larger than this segment in *emersoni,* and the parallel, longitudinal striae at the base of the antennal segments III to X, so well developed in *emersoni,* are rudimentary in *manni.*

Pronotum of *manni* much more robust, with the poorly defined transverse, antebasal impression much wider, so that in profile (P1. I, fig. 3) the pronotal disk *is* more gibbous.

Elytra of *manni* broader. Each elytron with a single antebasal fovea. This latter is the sutural fovea, the discal fovea being absent. Metathoracic wings present.

Abdomen with five visible tergites as illustrated. First tergite apically inflated so that this segment is almost as wide as the elytra, and much wider than the first tergite of *emersoni.* First and second tergites of *manni* lack the external lateral carina on each side. This is the most fundamental difference between *emersoni* and *manni,* and has served to place *manni as* the type of a new subgenus. The median cuneiform carina is relatively shorter on the first two tergites than in *emersoni.* Apical margin of third tergite almost straight, in contrast to this margin in *emersoni,* where it is arcuate. Apical margin of fourth tergite deeply incised, in contrast to this margin in *emersoni* where it is simply arcuate. Fifth tergite as in *emersoni* but longer.

Sternites as in *emersoni.*

Legs as in *emersoni* but the femora are more clavate in the distal two-thirds, and the parallel, longitudinal striae at the femoral bases, so prominent in *emersoni,* are rudimentary in *manni.*

The above description is based on the type specimen. This species is represented by three females, the type and two paratypes. The type and one paratype are deposited in the United States National Museum (USNM 59078), the other paratype is in the author's collection. I am indebted to Dr. Charles Seevers for calling my attention to this material, to Dr. E. A. Chapin for

making it available for study, and to Dr. Alfred Emerson for the identification of the host termite. All three pselaphids were collected by Dr. W. M. Mann at Bendija, Liberia during the Smithsonian Firestone expedition of **1940,** in the nest of ***Macrotermes natalensis*** (Haviland) variety ***tumulicola*** Sjöstedt.

There are several matters of intraspecies variation in ***manni*** that deserve attention. All three specimens show the strong, cuneiform internal carina on each side of the first tergite, but under very strong illumination and high magnification the side of the tergite shows a very fine line where the external carina occurs in the genotype and in ***emersoni.*** It was the presence of this trace that confirmed the desirability of placing ***manni*** in a separate subgenus.

The development of the intersegmental membranes of the abdomen is as great in ***manni*** as in ***emersoni*** and in the two paratypes of the former, the abdomen is so contracted that there appear to be only four visible tergites on casual inspection. The reason for this is that the fourth tergite has been retracted beneath the third so that only the margin can be studied without relaxing in hot water.

The cervicum also requires an additional note. Whereas the species lacks the three strong dorsal cervical carinae of ***emersoni,*** there are in ***manni,*** on either side of the median carina, a pair of very minute carinal lines. The development of the secondary cervical carinae varies between the three specimens. They are not shown in the plate because of their small size.

It is also worth noting that the basal elytral fovea in the type has its floor occupied by two secondary foveae or pits, and that in all three specimens there is a coarse, oval puncture on the crest of the vertexal vault.

GENERAL REMARKS

1. The present composition of the genus ***Connodontus*** is unsatisfactory. This condition will continue until there is a substantial increase in the number of available specimens for study and of field data with which to work.

At present there are several alternative combinations. There may be only three species populations known, e.g. ***acuminatus, silvestrii,*** and ***manni.*** If this is so, then the reported differences between ***acuminatus*** and ***termitophilus,*** and between ***silvestrii*** and ***emersoni, may*** represent (a) subspeciation, in which case there should be a correlation of structural variation with differences in areal range or some other isolating mechanism; (b) normal variation as between the sexes; (c) errors in the original descriptions; (d) omissions in the original descriptions. Study of a few specimens precludes both statistical manipulation and any effort at finding an area of intergradation if subspecies are involved.

On the basis of what is known, the most likely hypothesis is that there are five species populations known in the genus, as set forth in the preceding key.

2. Unfortunately the more extensive information on the host termites does not assist too much in the solution of the question of subspeciation in the pselaphids associated with them. Only two hosts are known, both of which belong to the same subgenus, *Bellicositermes.* These hosts are *Macrotermes bellicosus* (Smeathman) and *Macrotermes natalensis* (Haviland). In a personal communication, the author was assured by Dr. Emerson that these two hosts are very closely related, in fact that some specialists in Isoptera had thought that they might represent subspecies. Furthermore, the variety *natalensis tumulicola,* the host of *manni, may itself* be a subspecies, but lack of data on range has limited this line of thought. Both hosts occur over a very wide, but essentially similar, range in the Ethiopian Region (Emerson, 1928, p. 445-450), and both hosts appear to be adapted for savannah areas and only here and there have penetrated equatorial forest. Consequently, there is no series of subspecies of host, each with its own inquilinous population of *Connodontus;* the hosts occupy broadly similar areal ranges, and ecologically similar habitats.

So far, *acuminatus, termitophilus,* and *silvestrii are* known only from the northeastern ranges of their hosts (Abyssinia and the White Nile area of the Sudan). A fourth species, *emersoni,* is known only from the Leopoldville area of the Belgian congo, not closer than 1,200 miles from these three congeners. The fifth species, *manni,* known only from Liberia, is known no closer than 2,600 miles from the first three listed, and is 1,900 miles from the single collection made of *emersoni.* This extensive range of *Connodontus* is much less extensive than the known ranges of the hosts. Patently, we need more collections of these pselaphids.

3. There remains the role of *Connodontus* in the termite society. Relatively few pselaphids are known from the nests of termites (Wasmann, 1904; Park, 1942, 1946, 1947), and even less is known of their ecological interrelations with their hosts.

The record cited earlier (Raffray, 1882) of taking a specimen of *acuminatus* from beneath a stone, unaccompanied by host termites, has at least two interpretations. First, it is unexceptional to find myrmecophilic pselaphids apart from their hosts. For example, *Fustiger cornicen* Reichensperger (1933) has been taken from the forest floor in Costa Rica; *Decarthron monoceros* (Schaufuss), an inquiline of army ants, comes to lights at night (Park, 1942, 1945) in Panama and Dutch Guiana; facultative inquilines, including certain species of *Tmesiphorus* and *Batrisodes* are taken as often in floor mold as in

ant galleries (Park, 1932, 1933, 1947). Therefore, it is not unlikely that termitophiles may be taken apart from their hosts on occasion.

Second, it is possible that the specimen of *Connodontus acuminatus* under discussion was near or with its host, but that the latter were unobserved.

Lack of trichomes, and presence of well-developed mandibles and maxillae, suggest that *emersoni* and *manni* are not symphiles of termites, but rather occupy the role of tolerated inmates or synoeketes. They probably feed upon mites in the host nest, and possibly upon injured members of the society.

ABSTRACT

The Ethiopian termitophilus genus *Connodontus* contains five known species of pselaphid beetles. These are *acuminatus* Raffray, the genotype; *termitophilus* Wasmann; *silvestrii* Raffry; and two new species, *emersoni* and *manni.*

C. emersoni was collected near Leopoldville, Belgian Congo in a nest of *Macrotermes natalensis* (Haviland); C. *manni* was taken near Bendija, Liberia in a nest of *M natalensis tumulicola* Sjöstedt. Both of these new species are probably synoeketes of their hosts.

The anatomy of *Connodontus,* especially the remarkable intersegmental abdominal membranes, is discussed. The paper includes generic revision, in which a new subgenus, *Manniconnus,* is erected, with *manni* as its type; a key to the species; and general remarks on host-inquiline distribution and the position of these pselaphids in the complex society of their host termites.

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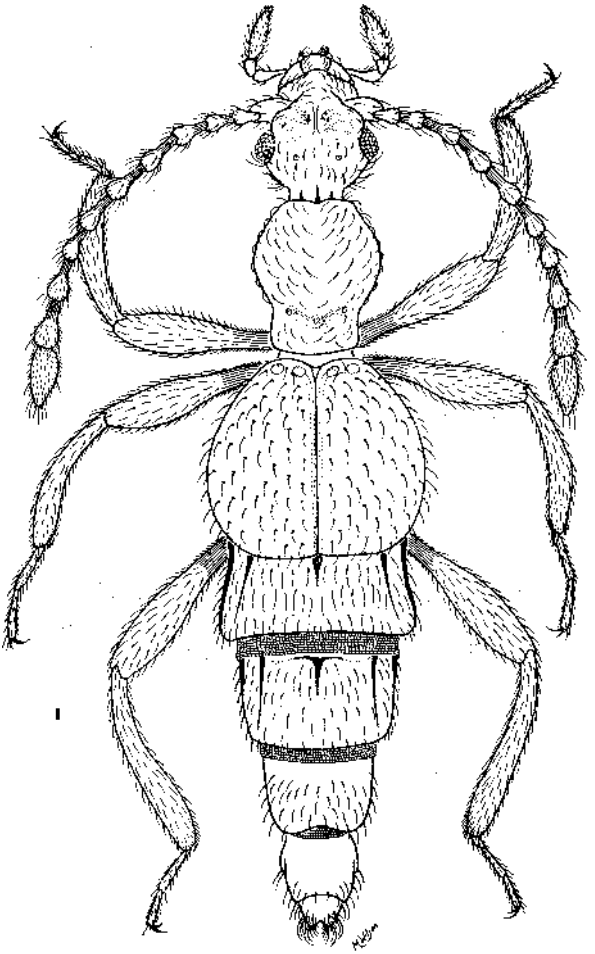
PLATE I

1. Connodontus emersoni new species, dorsal aspect.

2. Connodontus emersoni new species, profile of head and pronotum, semidiagrammatic.

3. Connodontus manni new species, profile of head and pronotum, semidiagrammatic.



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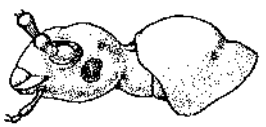

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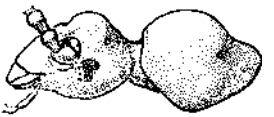

3

PLATE II

Connodontus manni **new species, dorsal aspect.**

Note: The author is indebted to Miss Marie Wilson, one of his graduate students, for the meticulous care with which the illustrations in this paper were prepared.